STRANGULATED RETROPERITONEAL HERNIA INTO THE PARADUODENAL FOSSA; OPERATION; DEATH ON THE NINTH DAY.

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Retroperitoneal hernia is rarely encountered on the operating table. Up to 1899 Moynihan could find only 57 cases on record of the variety into the left duodenojejunal fossa (to which type the present case belongs), the majority of these having been accidentally found at autopsy, and occurring independently of the disease producing death. Coley[1] says only 10 successful cases of operation have been reported, 9 of left and 1 of right duodenal hernia.

It is not an uncommon occurrence to have two or more of these retroperitoneal fossæ present in the same individual, so that it is difficult to give an accurate description of their boundaries. The folds which form the boundaries are formed in the fetus by the fusion of the left surface of the primitive mesentery of the duodenum with the right surface of the descending mesocolon, and become accentuated by traction made upon this line of fusion by the eventual drifting of the duodenum to the right and of the descending mesocolon toward the left. The fossa which became the seat of hernia in our case, and which is most frequently involved in cases of duodenojejunal hernia is known as the paraduodenal fossa or fossa of Landzert (1872). The fold producing it results from the presence of the inferior mesenteric vein, for which the fold acts as a mesentery. This vein, passing upward from the mesorectum, verges toward the midline on its way to empty into the splenic vein, and in most cases runs entirely retroperitoneally, not raising any fold or reduplication of the peritoneum. When, however, this fold, or *plica venosa* as it is called, is present, it consists of a vertical and a horizontal portion, the vertical being to the left of and below the fossa and the horizontal bounding the fossa above. Just to the left of this vein, the left colic artery is found, running upward from its origin in the inferior mesenteric artery. The lower boundary of the fossa is completed by a serous fold, the mesenterico-mesocolic fold, which runs from the left side of the mesentery downward and a little laterally to the right side of the upper mesosigmoid. To the mesial side of the paraduodenal fossa is the root of the mesentery. This paraduodenal fossa, then, is situated to the left of and some distance away from the ascending limb of the duodenum (Fig. 1). Posteriorly it is bounded by the peritoneum covering the psoas muscle, the renal vessels, the ureter, and a portion of the left kidney. Its orifice looks downward and to the right, its cavity upward and to the left. The width of its orifice depends on the distance of the inferior mesenteric vein from the duodenojejunal flexure.

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[1] Keen's Surgery, 1908, iv, 102.

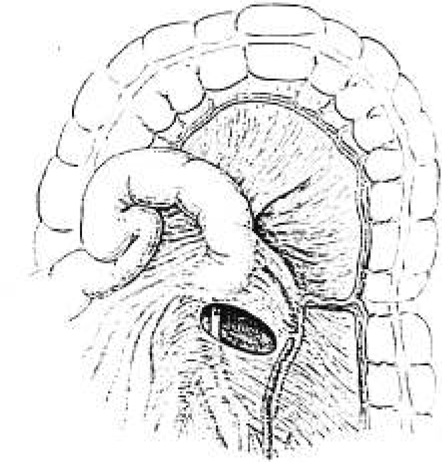

FIG. 1.—The paraduodenal fossa or the left duodeno-jejunal fossa. Note the inferior mesenteric vein and the left colic artery near the left border of the fossa. (After Poirier and Charpy.)

The causes of these herniæ are similar to those which produce other types. The presence of a deep fossa, with tense margins, and intestines which are freely movable, predisposes to the development of such a hernia. Under such circumstances a coil of intestine may be forced into the fossa by violent peristalsis or by the sudden increase of intra-abdominal pressure which follows crying in infancy or sudden strains in adult life. The hernia may develop almost at any age. Moynihan mentions a case in a child, aged fourteen days; and in herniæ which first cause symptoms in adult life, as in our own patient, a man, aged forty-seven years, it is often impossible to know how long the condition may have existed without causing any symptoms.

In most cases the previous history is negative, though, as in the present case, there may have been attacks of abdominal pain, generally ascribed to "indigestion." The symptoms of strangulation are merely those of intestinal obstruction, and frequently the patient is not seen until peritonitis has developed. If the patient be seen early the physical signs probably are more reliable than the symptoms. While the size of these herniæ varies considerably, they usually are of sufficient size to produce a circumscribed globular fulness which, when small, is located slightly above and to the left of the umbilicus. When they attain their maximum size, however, they may occupy one-third of the abdominal cavity. The prominence formed by the hernia is then especially noticeable in contrast to the flatter area to the right, occupied by the ascending and transverse colon and by the few remaining coils of small intestine not involved in the hernial sac. In this respect they may resemble those cases of intussusception which present Dance's sign. Sometimes, as the hernia increases in size, it may be discovered on palpation, or borborygmi and subjective symptoms may point to the region of the abdomen involved. To palpation, the mass may have either a doughy or a cystic feel, but no wave of fluctuation can be obtained. The statement made by Moynihan that the tumor always yields a sonorous note on percussion and clear intestinal sounds on auscultation, no doubt may be true in nearly all cases seen early, particularly when no strangulation is present; but in our own patient all intestinal sounds were absent, owing to beginning peritonitis; and the percussion note was dull, which may be explained by the presence of free fluid outside of the hernial sac and by the accumulation inside the intestines within the sac of three enemas which had not been expelled.

Other physical signs which are said to occur are the presence of hemorrhoids from obstruction of the inferior mesenteric vein in the neck of the sac, and also a dilatation of the superficial abdominal veins serving as anastomosis between the epigastric and mammary.

On opening the abdomen a large globular mass is seen, situated to the left of the lumbar vertebræ. This mass is neither cystic nor hard and nodular, but is doughy in consistency, and the coils of intestine can be palpated beneath the smooth peritoneal covering of the sac. The colon retains its normal relationships, with the exception of the descending portion, which is pushed far to the left side. The entire small intestine may be within the hernial sac, in which case the only coil emerging from the sac is that nearest the cecum. Some cases have shown coils of small intestine to enter and to leave the sac, thence to reënter and again to leave it. The case herewith reported showed a few coils of upper jejunum lying outside the sac, while the duodenojejunal flexure itself, and all the rest of the jejunum and the ileum, to within a few inches of the cecum, formed the contents of the hernial sac. The loops of intestine lying outside the sac, if there be obstruction, as in our own case, will be much distended; and after strangulation has existed for a number of hours, free abdominal fluid will be present.

The most plausible explanation for the enormous size of some of these herniæ is that the lower portion of the gut is the first to enter the sac, and that the remainder of the intestinal tube is carried into the sac by peristalsis, just as in an intussusception the intussusceptum is carried into the intussuscipiens. If the orifice of the sac be large, and if peristalsis be violent, portions of the interned gut may be forced out from time to time; or perhaps several widely separated loops of intestine may be involved from the beginning. Either of these factors would explain the condition in which portions of gut are seen to enter, leave, and again enter the sac. It, therefore follows that in reducing these herniæ at operation, traction should be made on the highest portion of gut involved, as it will be found this has been the last to enter. It also follows that the lowest portion of bowel involved is most apt to be the seat of strangulation; although this may arise at any part from the presence of adhesions or kinks, or from constriction at the orifice of the sac.

The enormous size of some of these herniæ has already been mentioned. Cases measuring as little as 1.5 x 2.5 cm. are on record, while others have been reported measuring 14.5 x 24.5 cm., the larger measurement being in the longitudinal axis of the body. In the present case no accurate measurement was possible; but it is sufficient to say that the sac appeared the size of a football, and filled about one-third of the entire abdominal cavity. These herniæ spread upward into the transverse mesocolon, outward toward the descending mesocolon, or outward and downward, as in the present case.

The sac may be described as a pocket in the peritoneum. It consists of a single layer of peritoneum in itself: The posterior surface rests upon the retroperitoneal structures while the anterior layer lies in contact with the posterior surface of the posterior parietal peritoneum, giving us two peritoneal layers anterior to the contents of the sac. The orifice of the sac, like the hernial mass, varies greatly in size. In the recorded cases the breadth has measured from 3.5 to 6.5 cm. and the length from 1.5 to 13 cm. In our case the diameter of the orifice was about 5 cm.; after incision of the constricting margin it was easy to introduce the entire hand into the sac.

In the treatment of these herniæ it is especially important to bear in mind the structures which run in the anterior wall of the sac, at or near its free margin, namely, the inferior mesenteric vein and the left colic artery. It is often necessary to relieve the strangulation before the hernia can be reduced; and when the vein lies close to the orifice the only place at which an incision can be safely made is at the lower border of the constriction through the mesenterico-mesocolic fold, keeping to the mesial side of the vein. In all cases careful palpation should be made for the location of these vessels and injury to them avoided. After relief of the strangulation the hernia should be reduced as described above, beginning with the uppermost loop of intestine. After reduction the intestines are to be treated as in other cases of strangulated hernia. Finally attention must be paid to the retroperitoneal sac, which will predispose to a recurrence of the hernia if nothing is done to prevent such a sequel. The simplest method of disposing of the sac is to close its orifice by sutures, sewing the free anterior margin to the posterior parietal peritoneum which covers the psoas muscle, etc. This is what was done in our case, owing to the poor condition of the patient. There are, however, two objections to this procedure; the first was shown in our case at autopsy ten days after operation, when the suture of chromic catgut was beginning to be absorbed, and the two peritoneal surfaces had not become tightly adherent, thus opening a way for a recurrence of the hernia. The second objection is the danger of cyst formation in this walled-off sac. The operation of choice, therefore, though only applicable when the patient's condition warrants a rather prolonged operation, is to excise the entire sac and then to suture the remaining two edges of peritoneum. In either operation the inferior mesenteric vein is constantly in danger of injury. And though its division and ligation, or even a similar treatment of the ascending branch of the left colic artery, might not entail a fatal result, injury to either would subject the patient to much risk, and considerably complicate the operation.

CASE HISTORY. Arthur C., aged forty-seven years, a laborer by occupation, was admitted to Dr. Frazier's service in the Episcopal Hospital, Philadelphia, September 25, 1915; discharged October 6, 1915 (died).

Family History. Negative.

Previous History. For years the man has had attacks of cramp-like pain in the upper abdomen. One especially severe attack occurred about eight years ago, but he recovered without operation. These attacks seem to occur more frequently after eating steak or crabmeat. Vomiting occurs and is followed by relief of the pain. The bowels are not constipated during these attacks, but move regularly once daily. Between these attacks the patient had been troubled at times by morning gagging; he does not know what causes this, but admits that in addition to the use of tobacco and the milder beverages, such as tea and coffee, he has always been a heavy drinker of beer. He has done heavy laboring work all his life.

Present Illness. The chief complaint is intense abdominal pain. The present condition began about sixteen hours previous to admission, with severe cramp-like pain in the upper abdomen. This came on him suddenly while at work, about 8 o'clock in the morning, and has continued without relief. The pain has remained generalized over the upper abdomen. Shortly after the onset of the pain he vomited a small amount of clear fluid. Vomiting has been repeated seven or eight times, and on the last occasion the vomitus was dark in color. Before admission to the hospital he was given three enemas by his physician; none of these were expelled. On admission he said his pain was somewhat relieved.

Physical Examination. The patient is well nourished and does not appear older than his given age. Inspection of the eyes shows a bilateral coloboma, which he states is congenital. Aside from this abnormality, the face, head, and neck are negative, as is the heart. Auscultation over the lungs, however, reveals an occasional rale at each base on deep inspiration. The abdomen is symmetrically distended; its walls are muscular, and there is no dilatation of the superficial veins. There is marked generalized rigidity, making palpation of the various organs or abnormal masses impossible. Palpation is painful over the entire abdomen, but especially marked above and to the left of the umbilicus. There is a peculiar doughy or cystic sensation to the palpating hand, different from that usually obtained in cases of peritonitis. On percussion the note seems unusually dull for gaseous distention, but no fluid wave can be obtained. The liver dulness appears to be about normal, though it cannot be accurately outlined. There is entire absence of peristaltic sounds. Examination of the extremities and external genitalia was negative. The white-blood cells numbered 18,000.

The patient was admitted to the hospital at midnight and refused to have any operation done. His vomiting continued, and by the following morning the vomitus was quite dark in color and was beginning to have a fecal odor. A second blood count showed 17,680 white-blood cells, with 88 per cent. polymorphonuclears.

Operation. Between 1 and 2 o'clock in the afternoon of the day after admission, and thirty hours after the onset of his acute condition, the patient finally gave his consent for operation, which was immediately performed. At this time the abdomen was immensely distended and tense; there was dulness all over, except under the left lower ribs, the tympany here being due to the stomach. There was great tenderness everywhere. No peristalsis was audible. No definite diagnosis was made,[2] but it was noted that "if this is peritonitis, there must be a quantity of pus under tension."

Nitrous oxide and ether were used for anesthesia, both of which were taken poorly. A right rectus (paramedian) incision was made in the epigastric and umbilical regions, the incision being enlarged subsequently to a length of 17 cm. (7 inches). Bloody serum poured out on opening the peritoneal cavity. (No growth was obtained from its culture.) A few coils of obstructed small intestine lay in the right kidney pouch, distended to 7.5 cm. in diameter, and almost black. No coils of intestine tended to protrude, and in spite of the large abdominal wound it was impossible to deliver those seen. The hand, introduced, felt a large cystic mass as large as a football in the center of the abdomen, and a few coils of collapsed intestine to the left and in the pelvis. These were evidently the descending colon and sigmoid. The liver, stomach, and pylorus could be felt in their normal positions above the mass. It was quite evident that all the small intestines, with the exception of the few obstructed coils first encountered, had entered a retroperitoneal hernia and were strangulated (Fig. 2). The entire mass was then delivered through the abdominal incision by depressing the abdominal walls around it. The orifice of the sac could now be seen, about 5 cm. in diameter, on the right side of the mass, the intestines

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[2] The diagnosis on admission was "perforated duodenal ulcer."

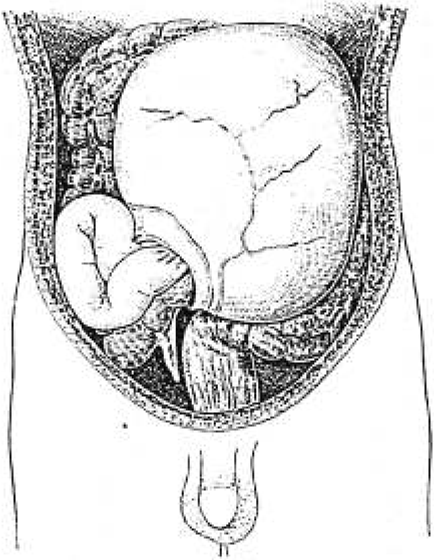

FIG. 2.—Diagram of a case of strangulated retroperitoneal hernia into the paraduodenal fossa.

having entered from the right and travelled toward the left. As no important bloodvessel could be detected in the constricting ring, its anterior margin was divided for about 1 cm. The coils of intestine contained in the sac were then easily delivered, beginning at the upper end. All these coils were distended and congested, but unadherent. Their contents evidently consisted of an accumulation of intestinal juices, plus the three unexpelled enemas which had been administered to the patient before his admission to the hospital. The last coil extracted was black and looked almost gangrenous for a distance of 25 to 30 cm. This last coil was continuous, with about 4 cm. of normal intestine, which had not been within the sac, and which appeared to enter the cecum. The upper coils of small intestine which had been within the sac were almost normal, and were directly continuous with the much distended coils of small intestine seen on first entering the abdomen, and lying in the right kidney pouch. These much distended coils in turn were continuous with the duodenojejunal flexure, which lay within the orifice of the sac on its cephalad margin.

The condition of the terminal loop of ileum gave most concern. Upon application of hot saline solution the normal color was partially regained, with the exception of numerous small spots, where it was feared perforations might develop. An anastomosis was considered, but owing to the patient's condition, and the difficulty of finding the large bowel (which was pushed out of sight by the hernial sac), this idea was abandoned. In addition to the damaged condition of the gut itself the bloodvessels in the mesentery of several coils of intestine were thrombosed.

The hernial sac was then explored, the orifice now easily admitting the surgeon's hand. It was found to be an invagination of the posterior parietal peritoneum to the left of the origin of the jejunum, and its entire contents, with the exception of the duodenojejunal flexure (which lay in the office), had been reduced. The free anterior margin of the orifice of the sac was now sutured to the posterior parietal peritoneum, with a continuous suture of No. 2 chromicized catgut. Gauze packs were removed from the abdomen, the intestines replaced, and the abdominal wound closed, without drainage, by means of heavy mass sutures of silkworm gut, passing through all layers of the abdominal wall; the anterior sheath of the rectus muscle was sutured separately with a buried suture of No. 2 chromicized catgut.

Postoperative History. The progress of this case is interesting for the remarkable attempt of nature to restore the abdominal condition to normal.

On the *first day* after operation the patient retained water neither by mouth nor by bowel. He passed no flatus, but the abdomen was only slightly distended.

On the *second day* gastric lavage was necessary both morning and evening to relieve distention and vomiting. However, 2 pints of water were retained by bowel and about 7 ounces by mouth.

On the *third day* gastric lavage was required once. Four pints of water were retained by bowel, and 10 ounces of broth totalling about 40 calories, by mouth.

On the *fourth day* gastric lavage was required once. Four pints of water and a nutritive enema containing 776 calories were retained by bowel, and 6 ounces of water and small quantities of broth and albumen, totalling about 6 calories, were retained by mouth. Beginning impairment of the percussion note at the base of the right lung was noted today.

On the *fifth day* the abdomen was softer, there was less pain, and the total quantity of vomitus was only 11 ounces. Nourishment of 1552 caloric value was retained by bowel and 18 calories by mouth. The lower third of the incision was infected. A clean-cut basal pneumonia had developed on the right.

On the *sixth day* the abdominal condition continued to improve; 1552 calories of food were taken by bowel and 85 calories by mouth. The abdominal incision was sloughing at its lower angle. Consolidation of the right base persisted and the patient was delirious at times.

On the *seventh day* the abdomen was distended and there was considerable vomiting. Rectal nourishment was discontinued and 1126 calories were given by mouth; all of this nourishment, however, was not retained. The infection of the abdominal incision did not seem to be spreading, but one silkworm-gut suture had torn out. The patient continued delirious at times.

On the *eighth day* the abdomen was softer and the patient was more comfortable. The total vomitus measured 10 ounces, while 5 pints of water and 826 calories of food were retained. The incision showed no marked change. Although the patient was still slightly delirious at times, he was less restless and the area of pulmonary consolidation seemed to be resolving.

On the *ninth day* the abdomen was soft and an alum enema was effectual. The patient retained practically all of 1159 calories of food, only slight vomiting occurring. The abdominal incision was beginning to granulate at the infected area. The mental condition was more rational and the consolidated area in the lung was becoming replaced by moist rales. Coughing was severe, and a note was made that the patient seemed to be on the verge of his crisis.

Unfortunately, toward evening, after a severe coughing spell, the patient became more restless and complained of pain in his incision. On removal of the binder and dressings it was found that about 2 feet of intestine were lying on the surface of the abdomen, the lower angle of the incision having given away. The intestinal coils were replaced under heavy doses of morphin and a few whiffs of chloroform, and the gaping part of the incision was sutured with through-and-through silkworm-gut sutures over a large gauze sponge, one end of which was allowed to protrude from the lower angle of the incision. Eight hours later the patient died.

It was impossible to obtain permission for an autopsy, but exploration of the abdomen through the operative incision showed that there was no active peritonitis. The sutures obliterating the orifice of the hernial sac were beginning to be absorbed, but very little agglutination of the approximated serous surfaces had occurred, so whether the end result would have been a complete closure of this opening it is impossible to say.

We mentioned in the description of the operation that the free margin of the hernial orifice contained no important structures and that it was incised for about 1 cm. in order to relieve the strangulation. More careful examination, postmortem, however, showed that the inferior mesenteric vein ran less than 2.5 cm. from the free margin, and that only a little further distant was the left colic artery, either of which might have been wounded had the incision been carried farther.

Examination of the intestines showed what wonderful attempts nature makes to restore a damaged organ to normal. Much of the gut had regained its normal color, while those spots which we described as gangrenous had doubled up on themselves and their healthy edges had become adherent, thereby inverting the damaged area more perfectly than the surgeon himself could have done. This occurred in two instances, while a third threatening perforation was protected by adherent omentum.

THE MINERAL METABOLISM OF EXPERIMENTAL SCURVY OF THE GUINEA-PIG.

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I. Historical. A glance at the literature of scurvy since our publication[1] early in 1912 shows the great interest manifested by many in the so-called deficiency diseases. Theodor Fröhlich and Valentine Fürst,[2][3][4] in 1912, reported further studies upon

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[1] L. Baumann and C. P. Howard: Arch. Int. Med., 1912, ix, 665.

[2] Ztschr. f. Hyg. u. Infectionskrankh., 1912, lxxii, 1.

[3] Ibid., p. 72.

[4] Ibid., p. 155.